

Vacuum Ultraviolet Spectro-Polarimeter Design for Precise Polarization Measurements

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Precise polarization measurements in the vacuum ultraviolet (VUV) region provide a new means for inferring weak magnetic fields in the upper atmosphere of the Sun and stars [1]. We propose a VUV spectro-polarimeter design ideally suited for this purpose (see Figure 1) [2]. This design is proposed and adopted for the NASA-JAXA Chromospheric Lyman-Alpha Spectro-Polarimeter (CLASP), which will record the linear polarization (Stokes Q and U) of the hydrogen Lyman- α line (121.567 nm) profile. The expected degree of polarization is on the order of 0.1% [1].

Our spectro-polarimeter has two optically symmetric channels to simultaneously measure orthogonal linear polarization states with a single concave diffraction grating that serves both as the spectral dispersion element and beam splitter (see Figure 1). This design has a

minimal number of reflective components with a high VUV throughput. Consequently, these design features allow us to minimize the polarization errors caused by possible time variation of the VUV flux during the polarization modulation and by statistical photon noise [3].

The CLASP has been assembled as shown in Figure 2 and shipped to United States in April 2015. The CLASP is planned to be launched at the White Sands Missile Range in New Mexico in September 2015.

References

- [1] Trujillo Bueno, J., et al.: 2011, *ApJ*, **738**, L11.
- [2] Narukage, N., et al.: 2015, *Applied Opt.*, **54**, 2080.
- [3] Ishikawa, R., et al.: 2014, *Sol. Phys.*, **289**, 4727.

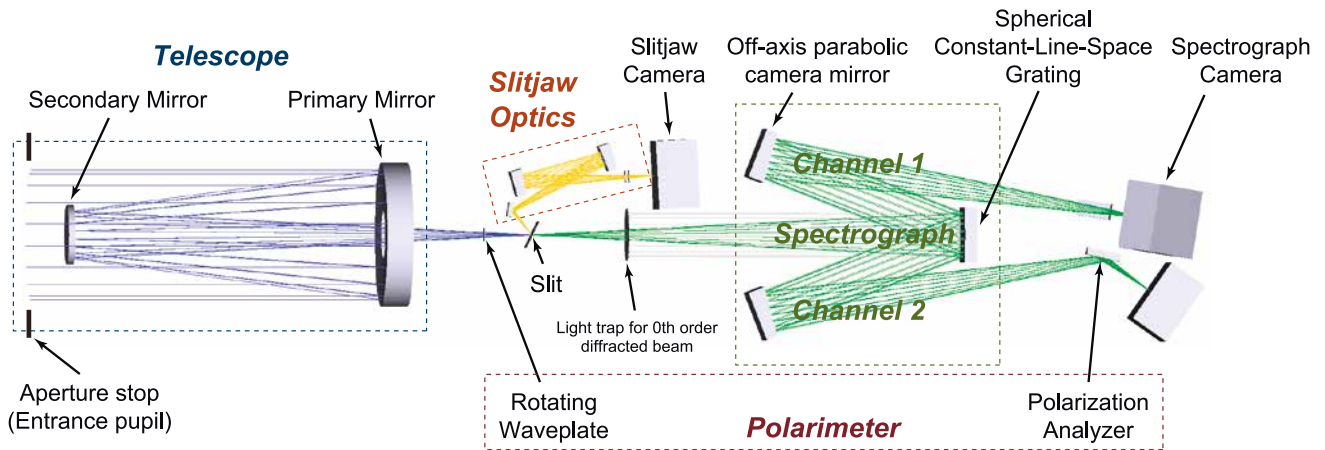


Figure 1: The VUV spectro-polarimeter design for CLASP. The complete optical layout of CLASP, consisting of the telescope, spectro-polarimeter, and slitjaw optics, is shown. A light trap is located between the slit and the grating to absorb the zeroth-order beam diffracted by the grating.

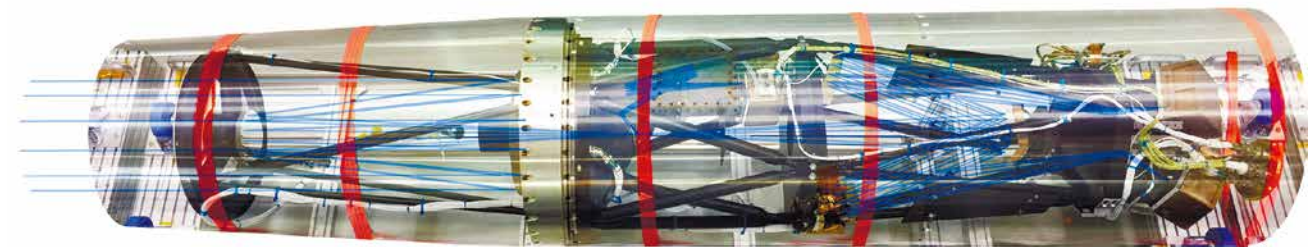


Figure 2: The assembled CLASP instrument. When the CLASP is launched, the instrument is covered with the rocket skin (semitransparent shell in this picture). The optical path is indicated with blue lines.